Eversource 345-kV Structure Replacement Projects (2021-2022)

Planning Advisory Committee Meeting

January 21st, 2021

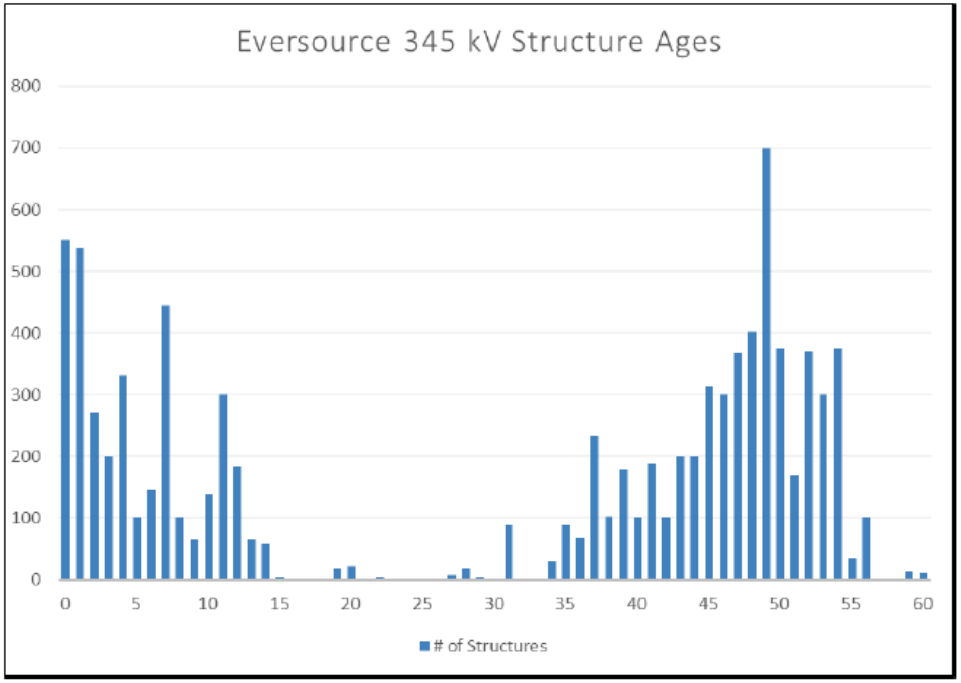
January 19th, 2021 Version

Agenda

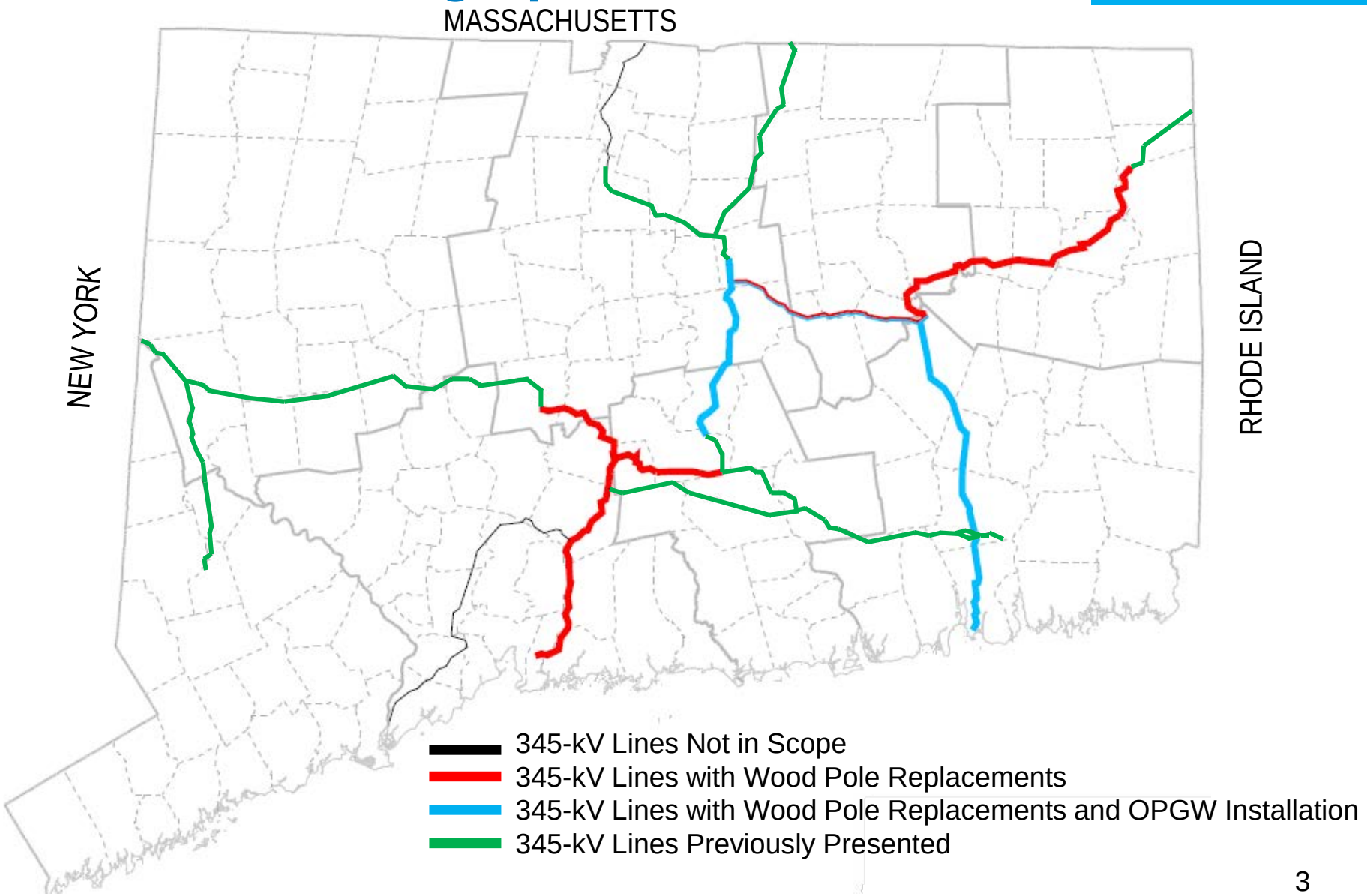
- Eversource 345-kV System Summary
- Project Background and Drivers
  - Reliability and Safety
    - Inspections, Criteria, Results
  - OPGW
- Scope Details
  - Line Characteristics, Asset Condition
- Summary and Conclusions

Eversource 345-kV System Summary

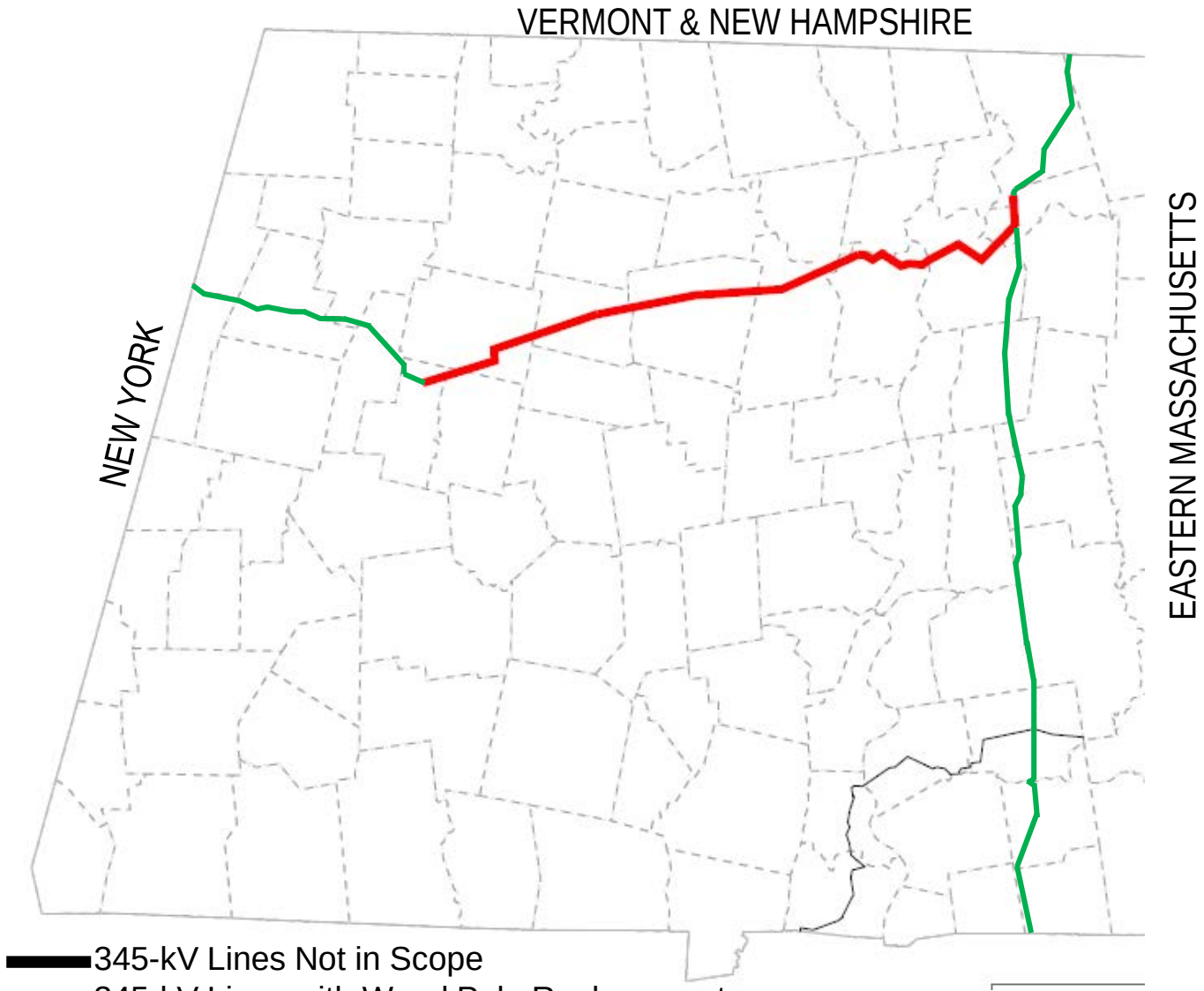
- Eversource manages ~1,250 miles of 345-kV overhead lines
  - Over 40% of all New England 345-kV PTF
  - Eversource has over 9,000 345-kV structures
    - This presentation targets ~550 of these structures
- The majority of New England 345-kV system was constructed in 1960s and 1970s
  - 345-kV structures targeted by these projects are typically wood, single circuit structures in an H-frame configuration



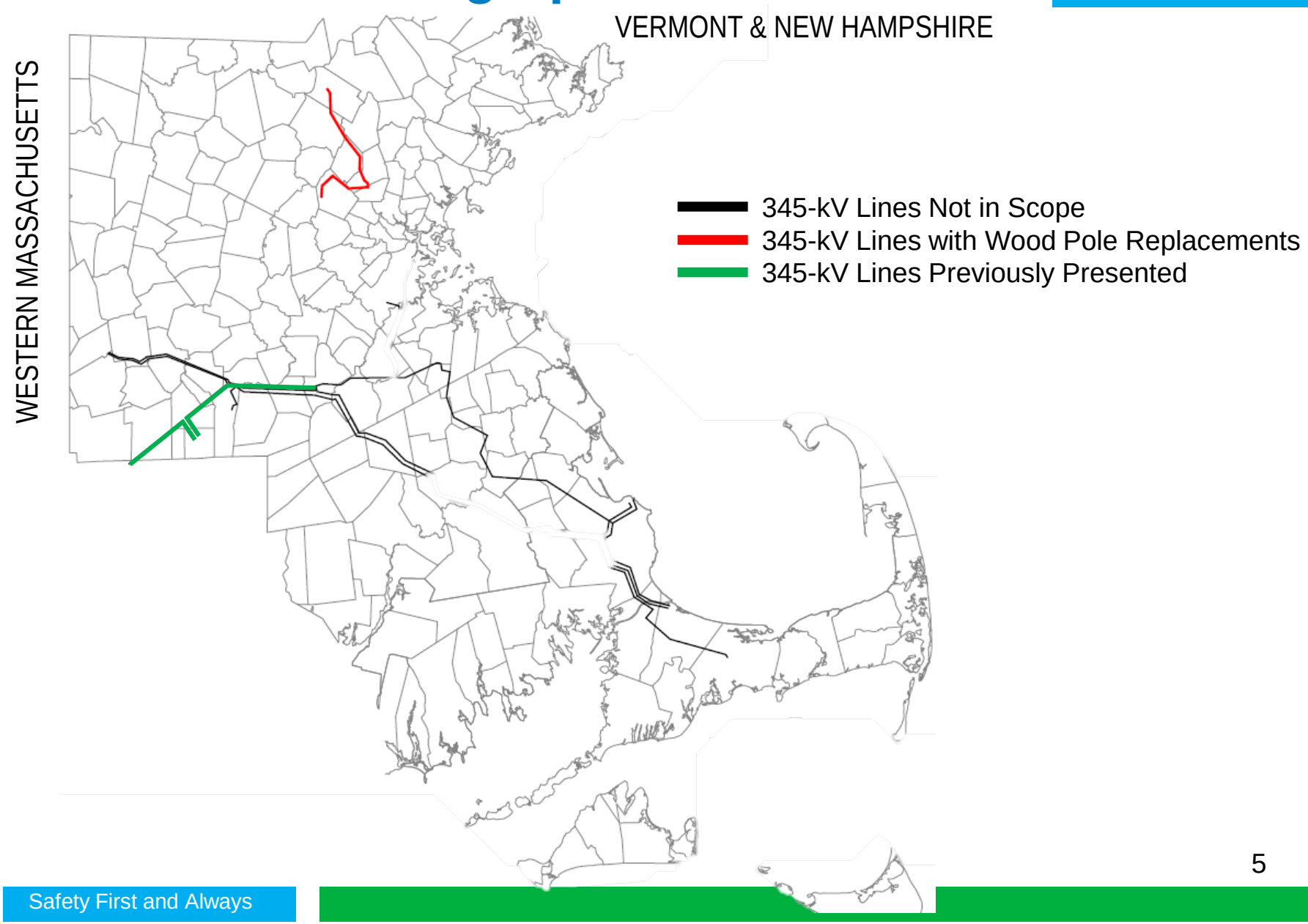
CT 345-kV Geographic Locations



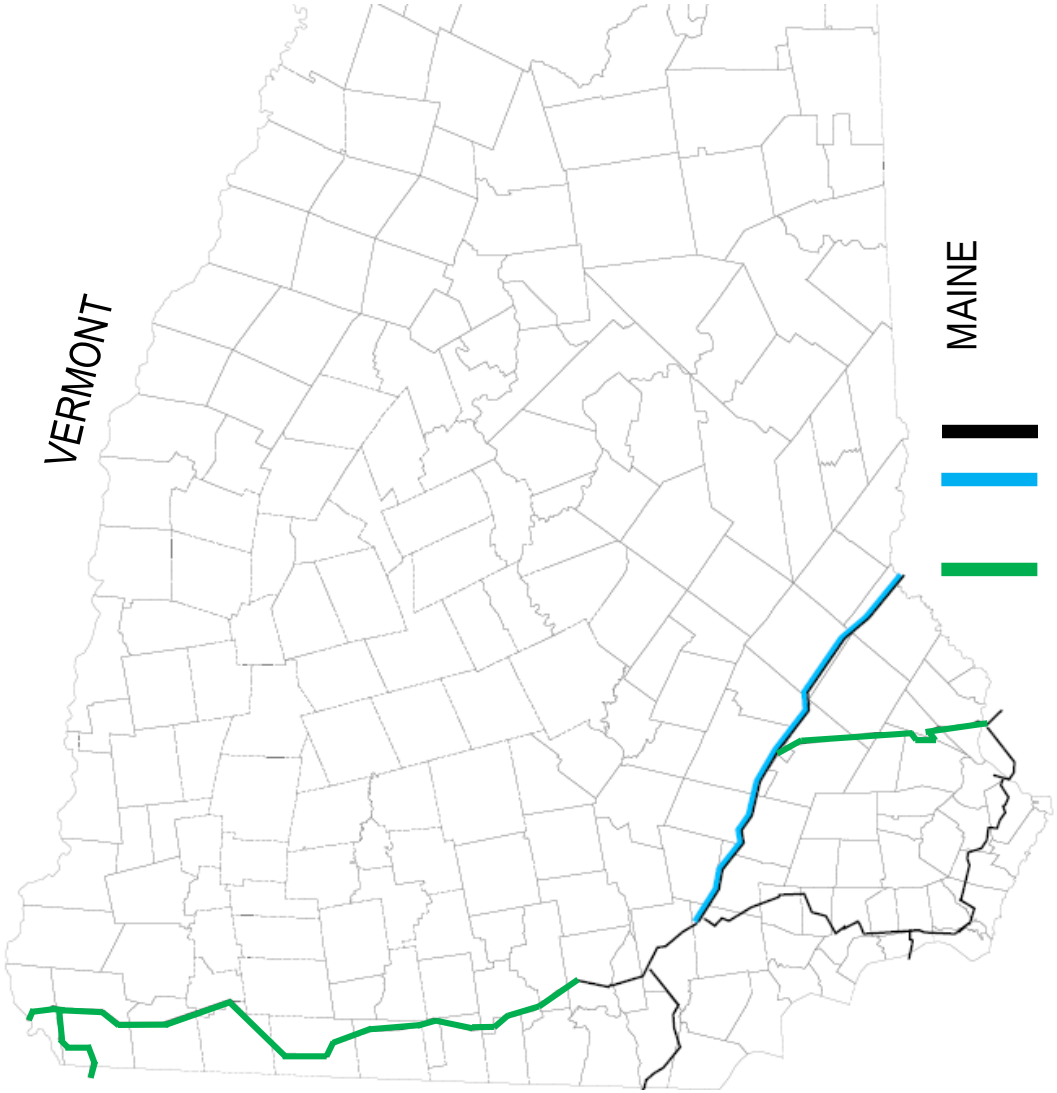
WMA 345-kV Geographic Locations



EMA 345-kV Geographic Locations



NH 345-kV Geographic Locations



- 345-kV Lines Not in Scope
- 345-kV Lines with Wood Pole Replacements and OPGW Installation
- 345-kV Lines Previously Presented

Project Drivers – Reliability/Safety

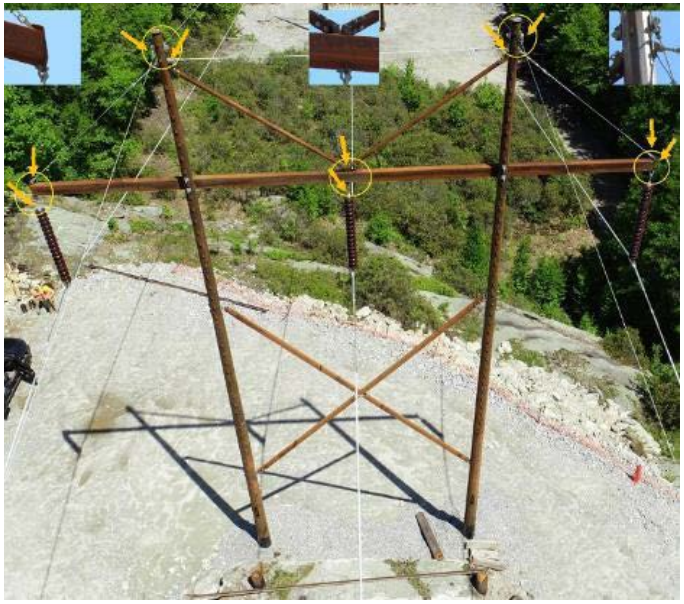
- Eversource is focused on safe and reliable operation of the transmission system, and frequent inspections are performed in accordance with the Eversource Maintenance Program
- Inspection results are reviewed by Maintenance and Engineering personnel
- Factors such as cost of structure components vs. cost of future access, environmental impact, and abutter impact will be assessed
  - Where there is significant cost and/or impacts associated with access to the structure in need of replacement (matting, etc.), the adjacent structure will be reviewed for consideration of replacement at the same time
- Structures that are being replaced will be reviewed for storm hardening and compliance with the most recent National Electric Safety Code (NESC) and Massachusetts Department of Public Utilities loading and clearance criteria
  - New structures are typically light-duty steel (wood pole equivalent) direct embed poles

Structure Inspections

- Current Inspection Standard utilizes ***Comprehensive Drone Inspection*** as Primary Means of Inspection
  - Combines foot patrol and aerial inspection details in one inspection
  - 2-in-1 inspection is more efficient when considering overall duration and frequency of inspectors in ROW easements during two separate inspections
  - High-definition cameras on drones allow for inspectors to see possible damage from all angles and take better photos
  - 345-kV system is inspected on an annual basis

- <u>Items Reviewed – Wood Structures</u>
  - Significant woodpecker damage
  - Severe checking/splits/cracking
  - Insect damage
  - Rot or decay
  - Severe fracturing, buckling, leaning
  - Compression breaks
  - Fire damage
  - Damage/Vandalism
  - Hardware/Insulator damage

Drone Inspections



Inspection Grading & Project Scoping

- Structures are graded in accordance with Electric Power Research Institute (EPRI) Guidelines
  - *A: Nominal Defect – No Action Required*
  - *B: Minimal Defect – Monitor Degradation*
  - *C: Moderate Defect – Repair or Replace under next maintenance*
  - *D: Severe Defect – Repair, Reinforce, or Replace immediately*
- Replace C and D structure in one mobilization
  - Other structures (A/B) may be replaced during scope due to engineering requirements and to minimize costs and environmental impacts
- Engineering provides training to inspectors on appropriate grading criteria
  - Field inspectors provide structure grade while in field and observe the entire structures. Results are reviewed by engineering team and field operations

Inspection Results

- Utilization of drones has resulted in significant increase in identified defects
- Inspections continue to indicate significant degradation and decreased load carrying capacity of aging 345-kV wood structures
  - Additional deteriorating structures identified after projects presented to PAC in August of 2019
- Issues can be detected by visual inspection, but there are also many which are not apparent until the structure is replaced, or more detailed inspections are performed
- Proactively replacing the structures resolves multiple structural/hardware issues and supports safe and reliable operation

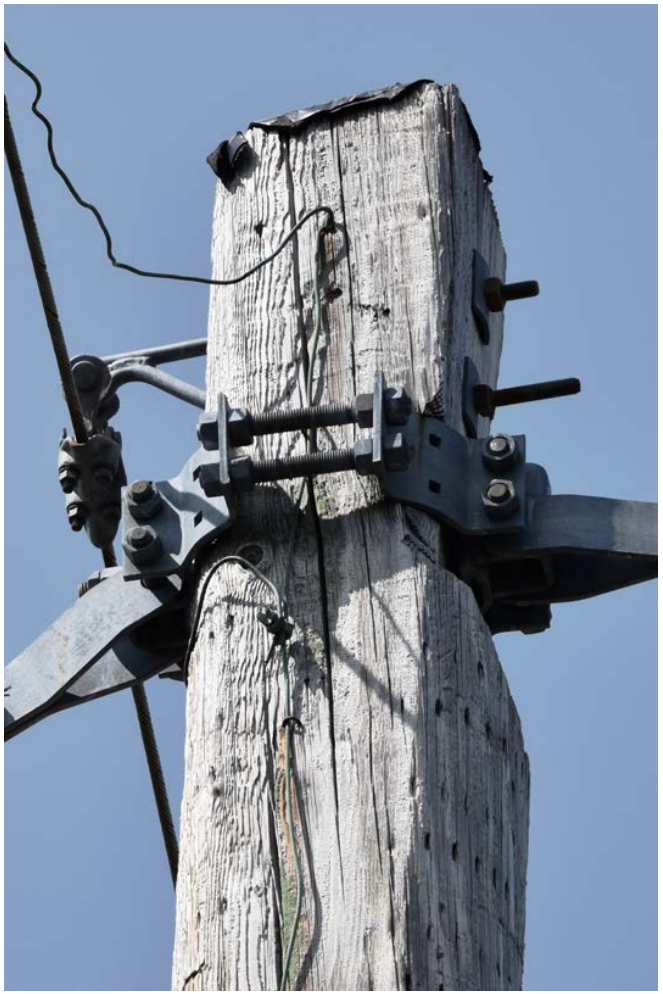
Pole Top Rot

Pole Top Rot –
Line 387

Pole Top Rot –
Line 387

Pole Splits

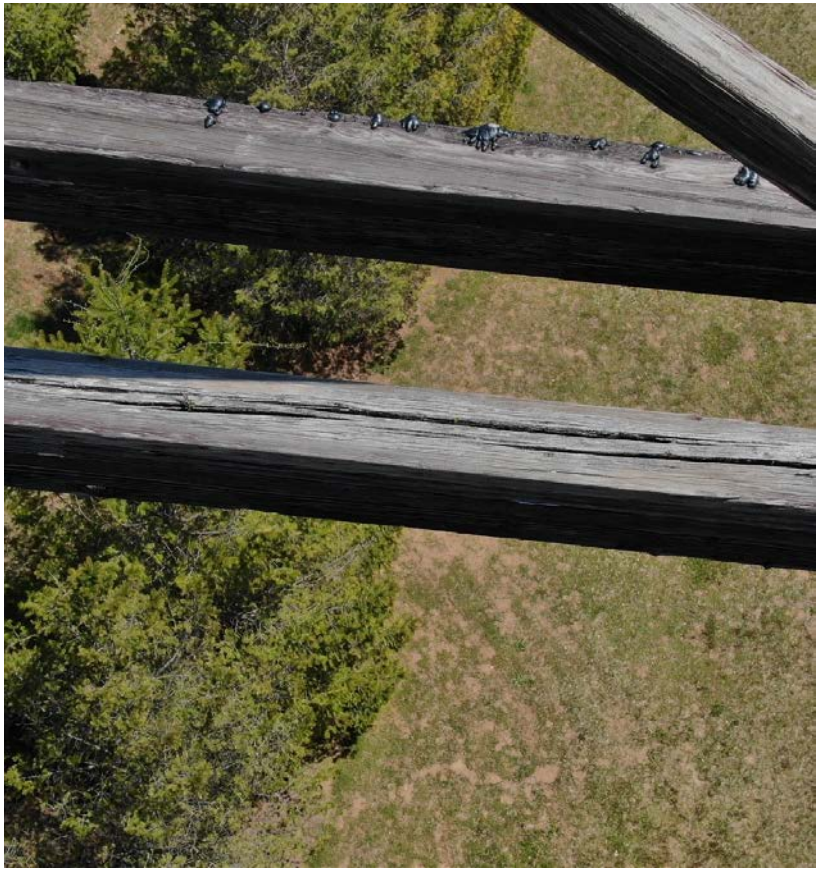
Pole Splits –
Line 310



Pole Splits –
Line 319

Cross Arm Damage

Cross Arm Damage – Line 3754



Cross Arm Damage –
Line 3754

Woodpecker Damage

Woodpecker Damage –
Line 387

Woodpecker Damage –
Line 3041

Project Drivers – Optical Ground Wire (OPGW)

- OPGW installation expands a private Eversource OPGW / Synchronous Optical Networking (SONET) loop
  - This will provide a controlled alternate fiber communication path supporting the long term build out initiative of the fiber optic network. This greatly reduces the reliance on leased services for protection, SCADA and future Phasor Measurement Units (PMU) and Dynamic Disturbance Recorders (DDR) installations (ISO-NE OP-22)
  - A private network is segregated from third-party Telecom services improving the overall reliability and security of the communications path to BES Cyber Systems
- CIP: Fiber provides the necessary bandwidth for physical security monitoring and triaging of alarms for BES Cyber Systems at Medium and Low impact substations

Project Drivers – OPGW (cont'd)

- SCADA Load Shedding procedures are directed by ISO OP-7 and OP-13. SCADA load shedding is required for a rapid response to prevent cascading contingencies and/or equipment damage
  - OPGW provides a dedicated communication path allowing high-speed operations
- The DOE and EPRI recommend fiber as a means to strengthen the security and resilience of critical communication infrastructure on which the nation depends against the consequences of electromagnetic pulse (EMP) attacks
- Fiber optic cable is a non propagating media for electric and magnetic fields (EMF) and therefore is considered generally immune to the effects of geomagnetic disturbances

Project Drivers – Hardware

- PINCO insulators must be replaced to ensure continued reliability
  - PINCO insulators have not been installed on Eversource system since the late 1980s
  - May 2017 PINCO insulator failure on 310 line prompted additional testing
  - EPRI testing revealed that PINCO insulators were defective and failed below mechanical and electrical ratings
- Replacements of PINCO insulators, where applicable, will be coordinated with structure replacements

Fragments of Failed PINCO Insulator – Line 310

Summary of Work

State	Line	Replacement Structures	Total Line Structures	OPGW (Miles)	Estimated Cost ($M) -25%/+50%
CT	310*	179	410	47.0	59.2
	330	24	264	-	6.6
	368*	32	168	-	8.8
	383*	48	277	9.0	16.3
	387*	37	230	-	10.2
	3041*	41	161	-	14.4
	3424*	37	135	10.0	14.9
	3754*	16	106	-	5.0
MA	312	77	318	-	19.3
	319	25	72	-	7.8
	338	29	66	-	8.7
NH	373	22	178	18.5	9.8
Total		567	2,385	84.5	181.0

Scope is exclusive of any prior presented work for all lines
* Scope includes PINCO insulator replacements

Conclusion

- The scope of 345-kV replacement structures is for 567 structures at estimated cost of $181.0 M (-25%/+50%)
  - Structures to be replaced with light-duty tubular steel pole structures. New structures will comply with current clearance and strength code requirements.
  - Replacement schedules to be determined

Eversource Totals			
State	*Replacement Structures*	*OPGW (Miles)*	*Estimated Cost ($M)*
CT	414	66.0	135.4
MA	131	-	35.8
NH	22	18.5	9.8
Total	567	84.5	181.0

Questions